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F2K K4B3

(56) Documents Cited
CH 000272368 A
DE 000271663 A
JP 630219917 A
US 4311435 A
US 2811025 A
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(54) Abstract Title

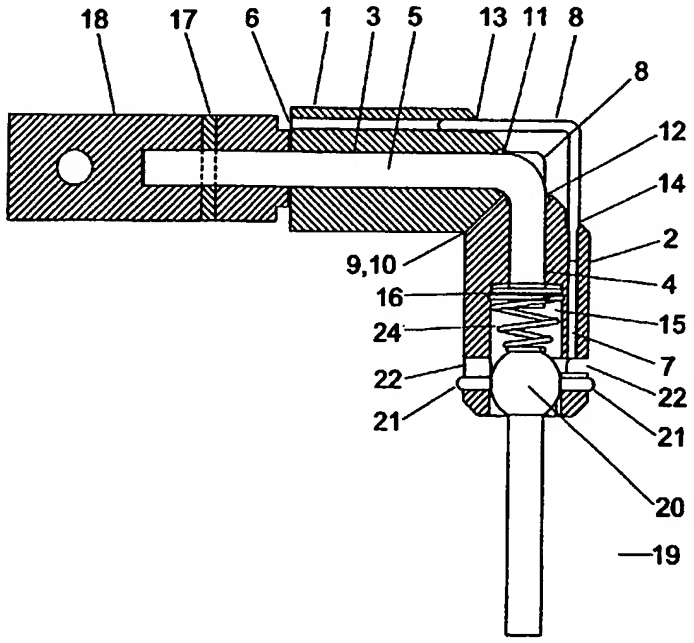
Angled power transmission coupling

(57) An angled power transmission coupling can form an integral part of the hub of air turbines, propellers and other rotary devices.

A coupling comprises axially bored elements 1,2 positioned either side of a bend or joint in a common integral axle. Rotational motion is imparted by the action of drive pins 8 which are bent about their centres to the same angle as the integral axle. The drive pins slide and rotate in axial holes 7 bored circumferentially about the axes of the driving and driven elements.

At the driven end of the integral axle, a means is provided to releasably mount the angled power transmission coupling 18, together with its rotary device. At the driven end of the coupling, a means is provided 22 to connect a drive shaft 19 or similar torsional device to transmit the rotary motion to its destination.

Figure 1



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The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

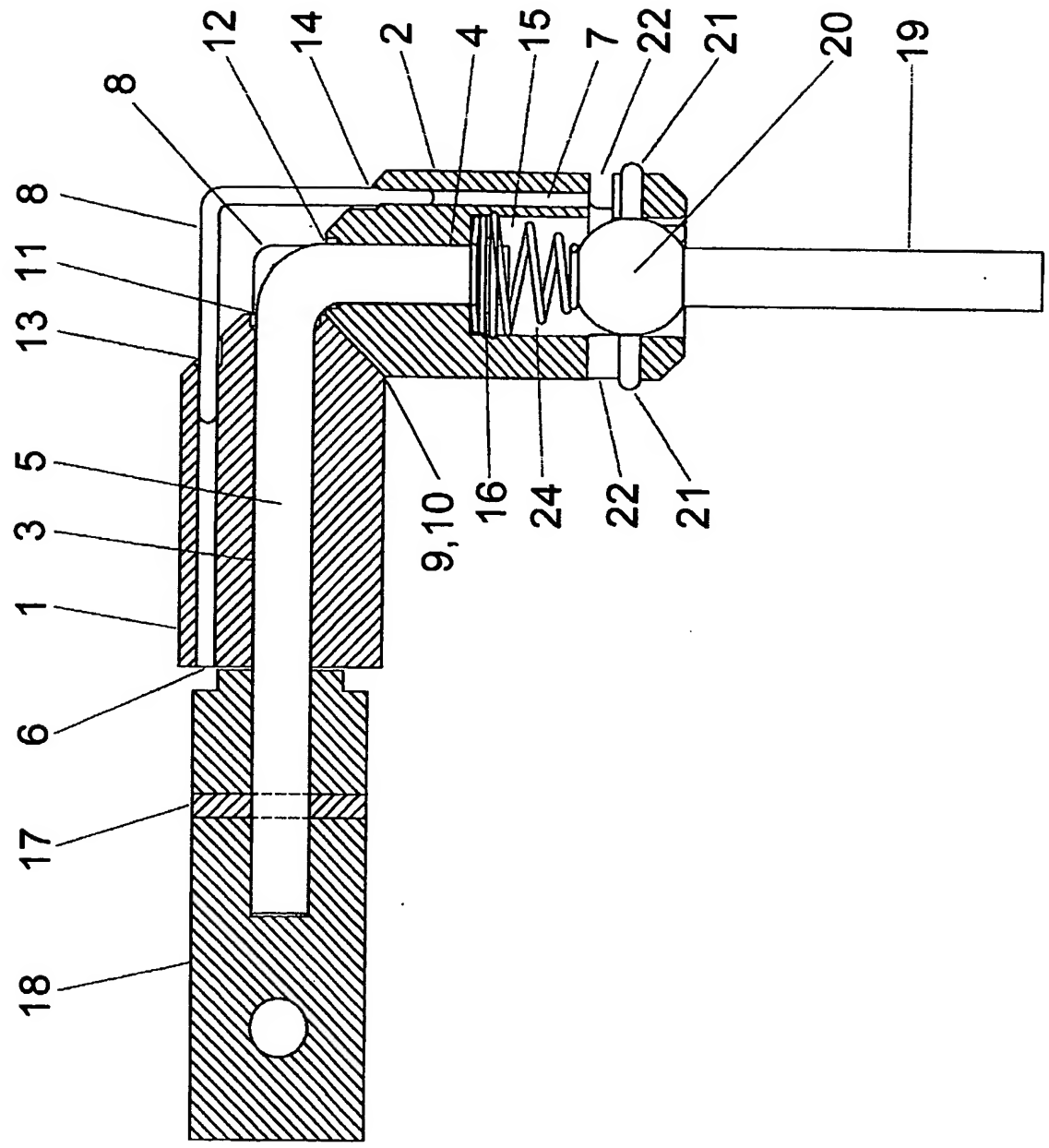
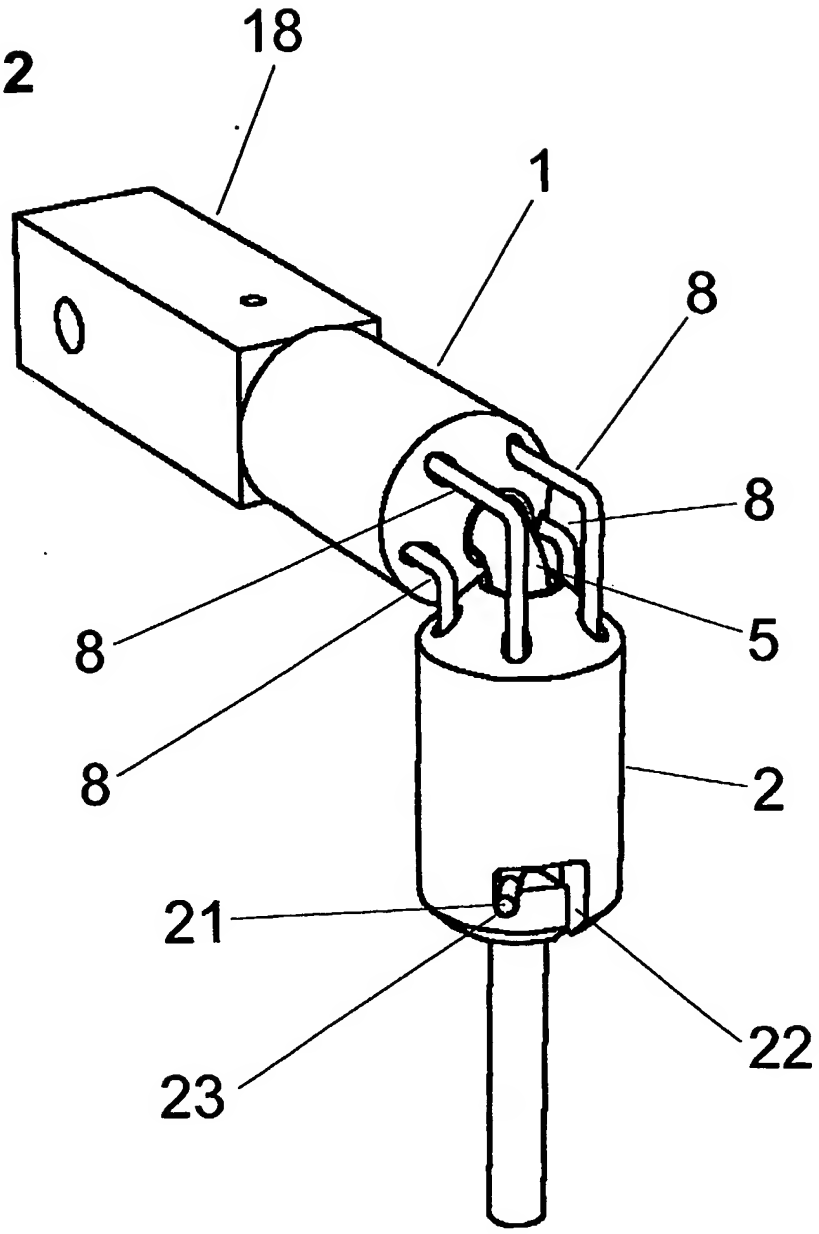


Figure 1

Figure 2



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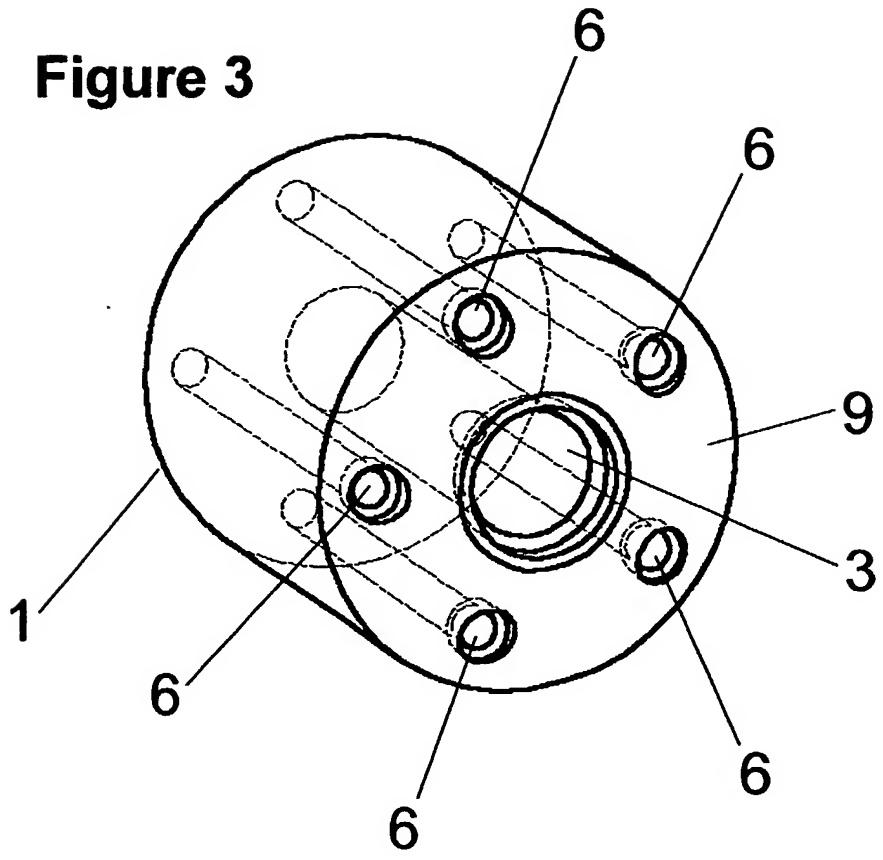


Figure 4

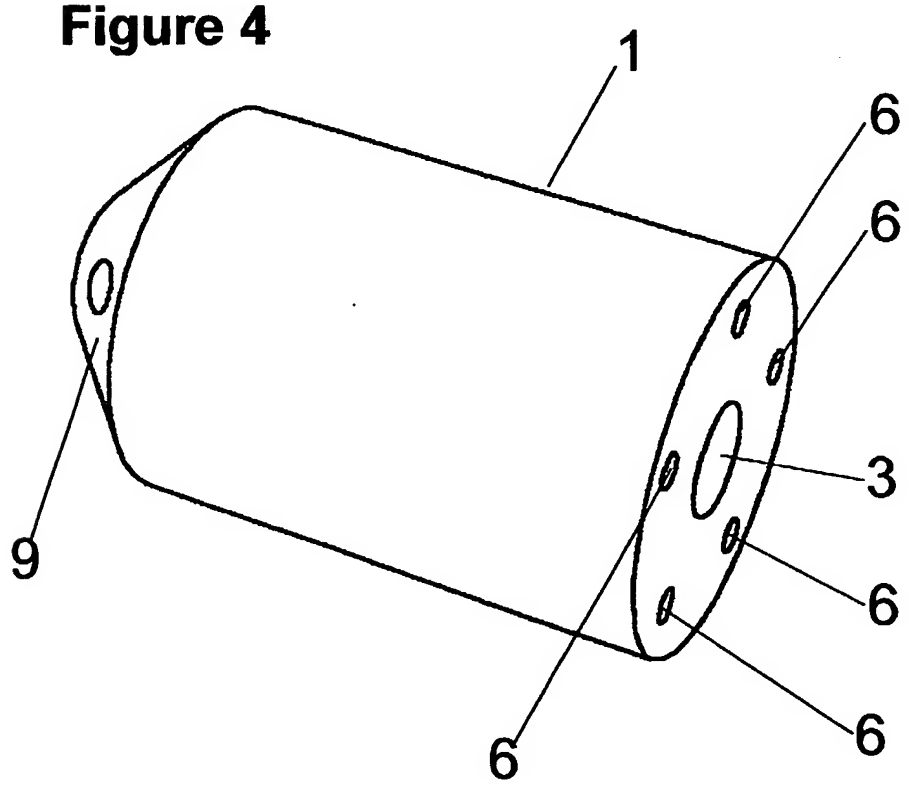


Figure 5

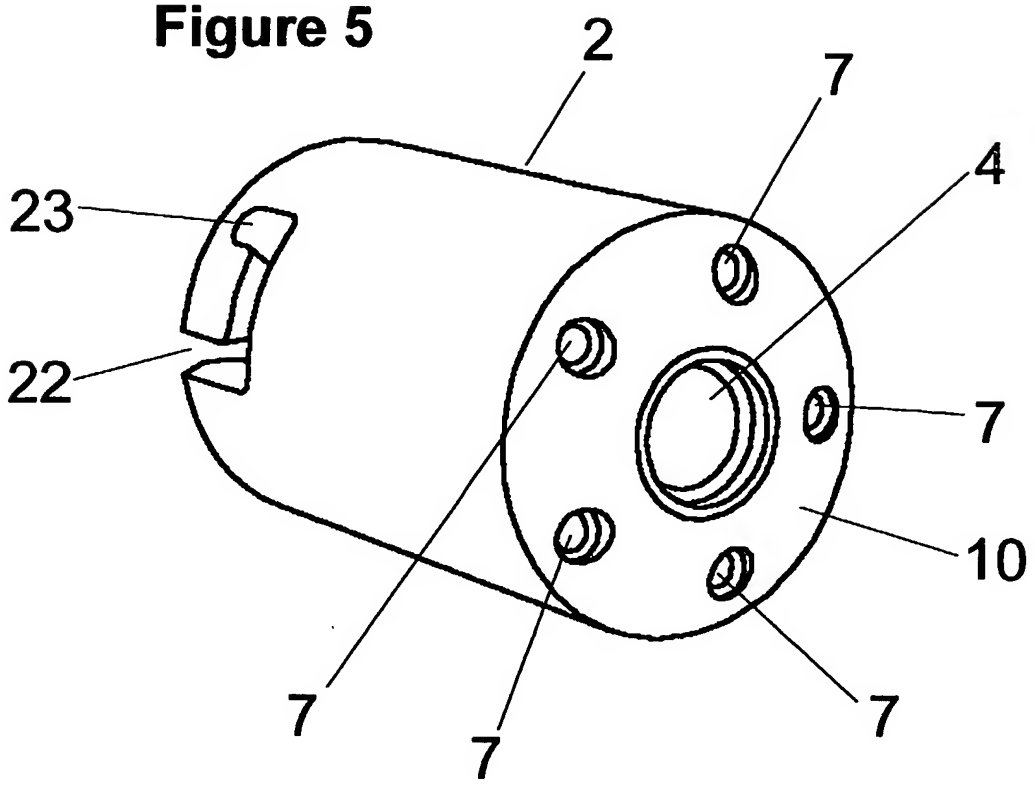


Figure 6

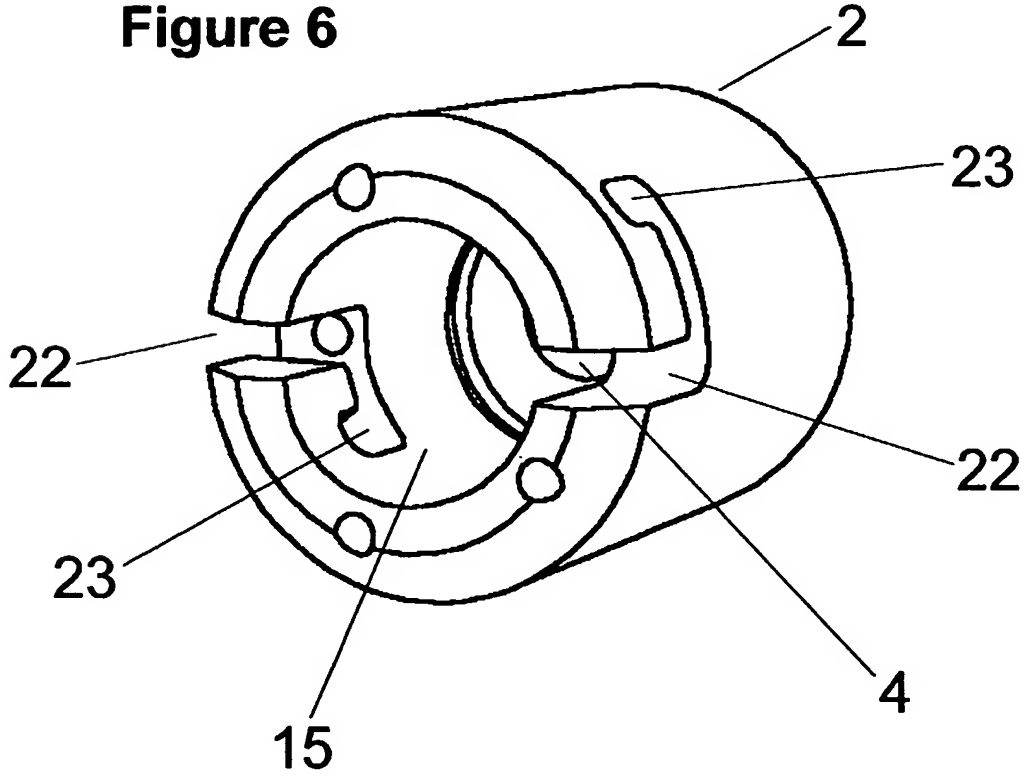
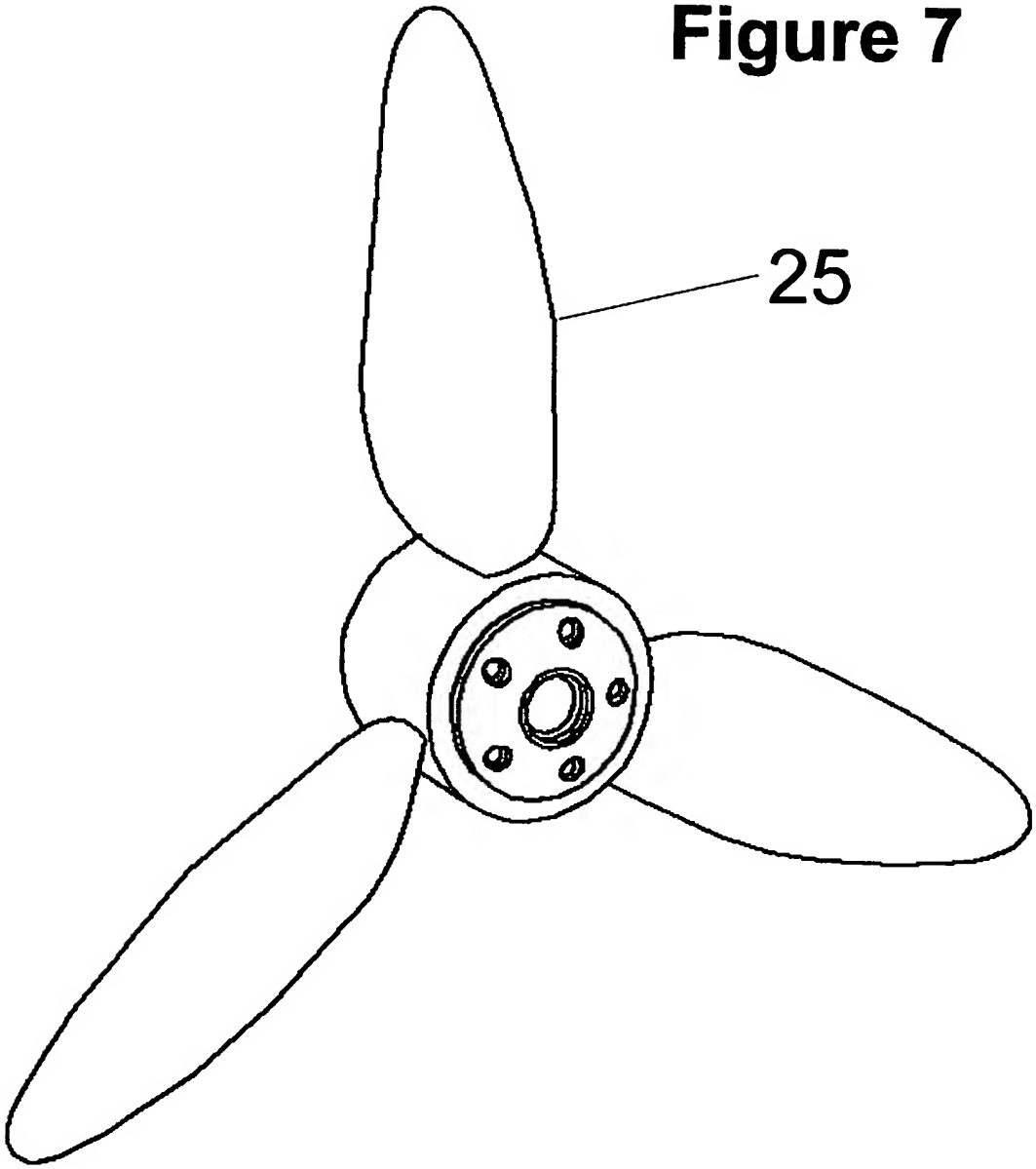


Figure 7



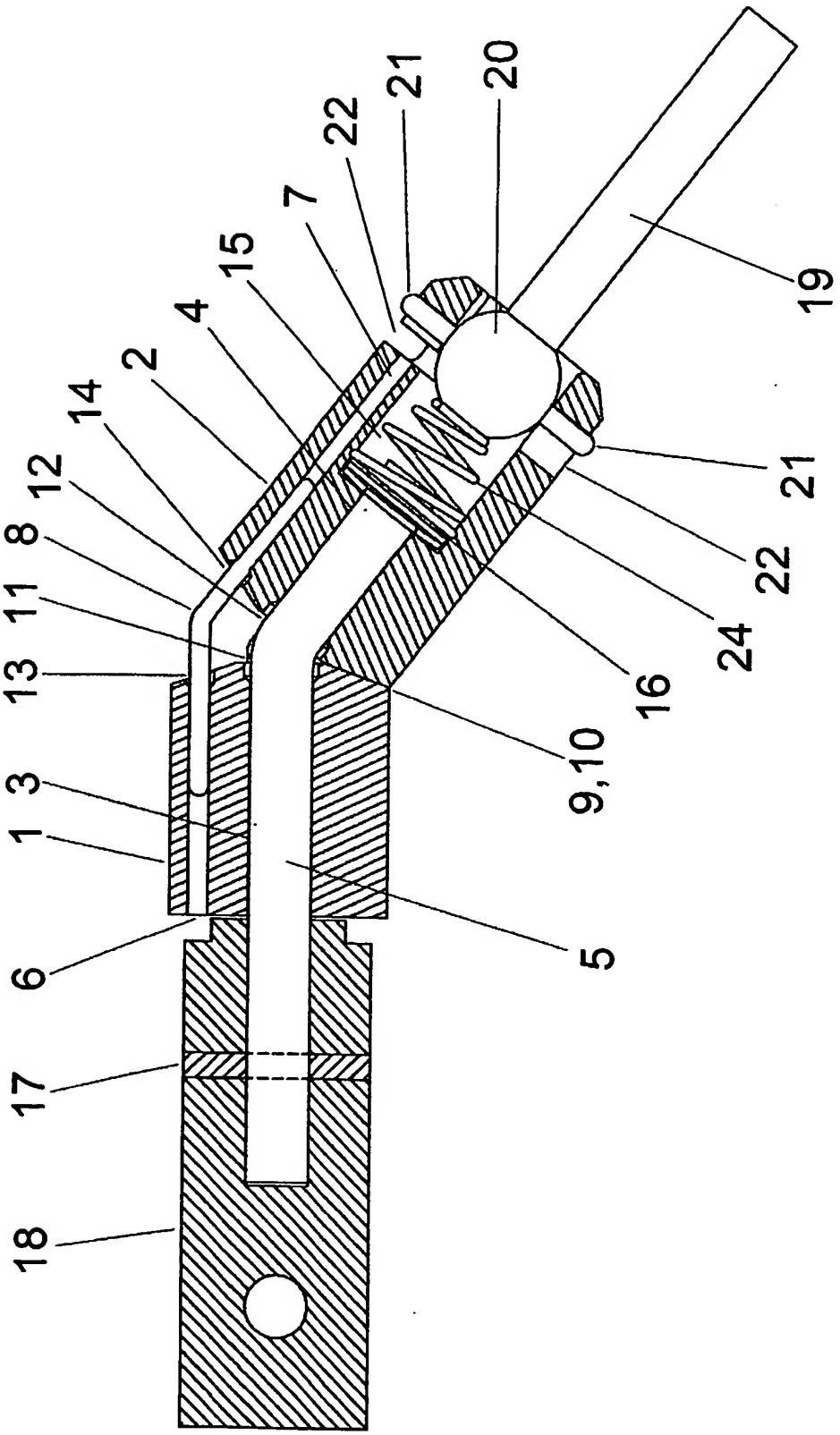


Figure 8

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ANGLED POWER TRANSMISSION COUPLING

This invention relates to an angled power transmission coupling, capable of translating rotary motion through a range of predetermined angles, usually between 0° and 130°, from a driving element to a driven element and vice versa.

The coupling was developed to provide a robust, low cost, weatherised drive for a combined wind and water generator. The design objective was to produce a device likely to be more reliable in service than one utilising gear wheels, which usually require close engineering tolerances and containment within a casing.

The object of this invention is to provide an angled transmission coupling that can be mounted using the end of its integral axle, whereby the direction of the translated drive can be accurately maintained through the use of a rigid mounting, or re-orientated by the use of an adjustable mounting.

According to the present invention, there is provided an angled power transmission coupling which provides a mounting point, axle and angular directed output for rotary devices such as wind turbine rotors and water impellers, by virtue of forming an integral part of the hub of the aforementioned rotary devices.

Preferably the device should be manufactured from materials chosen to maximise the performance, service life and utility of the coupling. Stainless steel pins and axles, together with self lubricating thermoset laminate bearing materials are used in a version of this device employed to transmit light torsional loads in a marine environment.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a coupling which translates rotary motion through an angle of 90°. The rotational elements 1,2, mounting bracket 18 and securing pin 17 are shown in section.

Figure 2 shows an isometric view of the coupling in Figure 1.

Figure 3 shows an isometric view of the conic face of a driving rotational element of the power transmission coupling, including hidden detail.

Figure 4 shows an isometric view of the rear face of a driving rotational element of the power transmission coupling

Figure 5 shows an isometric view of the conic face of a driven rotational element of the power transmission coupling.

Figure 6 shows an isometric view of the rear face of a driven rotational element of the power transmission coupling.

Figure 7 shows an isometric view of a driving rotational element as an integral part of a water impeller.

Figure 8 shows a coupling which translates rotary motion through an angle of 38°. The rotational elements 1,2, mounting bracket 18 and pin 17 are shown in section.

As shown by the example in Figure 1, each angled power transmission coupling comprises two rotational elements 1, 2, with holes 3, 4 bored centrally along their axis to accommodate a common axle 5. The axle 5 is bent to an angle corresponding to the desired angle of rotational translation. In Figure 1 this is 90°. Each of the rotational elements is provided with a plurality of drive pin holes 6, 7 bored parallel to the central axis and evenly spaced on a circumference that falls within the diameter of the rotational element. This is also shown in Figures 3, 4 and 5. The coupling is usually provided with four or more such drive pin holes to ensure smooth operation.

Drive pins 8 are provided which are a clearance fit for the drive holes. They are bent usually at their centres to an angle corresponding to the desired angle of rotational translation of the coupling. The mating surfaces 9, 10 of the rotational elements are shaped conically such that each corresponds to half of the total angle through which the transmission coupling translates the drive. These surfaces 9, 10 bear against each other when the coupling is running and remove the need for any kind of central bush on the axle 5. In order to accommodate the bend radius of the axle 5, both axle holes 3, 4 are relieved 11, 12 within the two rotational elements 1, 2. The pin holes 6, 7 are relieved similarly 13, 14 to accommodate the bend radius of the pins 8.

The rotational elements are assembled onto the axles and pins as shown in Figure 1. When either rotational element is turned, motion is transmitted to the other rotational element by the action of the drive pins 8, which rotate and slide within the drive pin holes 6, 7.

Figure 1 shows a section through a coupling designed to transmit motion through an angle of 90°. The axle 5 and pins 8 are bent to 90° and the conic mating surfaces 9, 10 of the rotational elements 1, 2 are machined to 45° relative to the element's axis.
Figures 3 and 4 show isometric views of a driving rotational element. Figures 5 and 6 show isometric views of a driven rotational element. It should be noted that both pin and axle holes pass right through the elements 1, 2. This is to prevent the possibility of hydraulic or pneumatic lock as the drive pins 8 move in and out of the holes. This also facilitates the self-cleaning of the bearing surfaces where contaminants can be ejected by the motion of the pins.
At the opposite end of the driven rotational element 2 from the conic mating surface, the element is bored out axially to form a drive shaft socket 15 as illustrated in Figures 1 and 6.
As shown in Figure 1, the driven rotational element 2 is secured to the axle 5 by use of a circlip 16, split pin or similar device of known design. The free length of the axle that passes through the driven rotational element 2 is arranged such that the angle formed by the conic mating surfaces 9, 10 bisects the angle formed by the bend in the axle 5.
The axle 5 that passes through the driving rotational element 1 is secured at its outer end by locating it within a clearance hole in a support structure, such as mounting bar or bracket 18. The axle 5 is prevented from moving relative to the mounting bar through being secured by means of a pin 17 or similar device of known design. The free length of the axle which passes through the driving element is arranged such that the angle formed by the mating surfaces 9, 10 bisects the angle formed by the bend in the axle 5.
The free length of the axle 5 that passes through both driving 1 and driven 2 rotational elements is further arranged such that sufficient axial clearance exists for both elements to rotate freely, whilst their conic mating surfaces 9, 10 remain in nominal contact. The relieving of the axle hole 11, 2 and the drive pin holes 13,14 provides a clearance to accommodate the bends in axle 5 and drive pins 8.

In the present embodiment of this invention, torque is supplied to the driving rotational element 1 by a wind turbine or a water impeller. In both instances the driving rotational element is located centrally and axially aligned within the hub of the turbine or impeller 25, as shown in Figure 7. The axle 5 therefore becomes the axis of the rotors, and the angled power transmission could be viewed as being integral to the rotors.

A means is provided within the driven rotary element 2 to connect a drive shaft 19 in order to transmit the rotary motion to its destination. This could take the form of an external sleeve placed over the driven rotational element 2 or a keyed shaft placed internally.

In the present embodiment of the invention as shown in Figure 2, a ball 20 is provided which is drilled through its centre to accommodate a drive shaft 19. A drive shaft pin 21 passes centrally through the ball at right angles to the drive shaft. As shown in Figures 1, 2, 5 and 6, shaped slots 22 are provided within the wall of the drive shaft socket 15. These slots 22 are arranged to produce a bayonet fitting with locking groove 23, as in Figure 6, or similar device of known design. A conical spring detent 24 or similar device of known design is provided within the drive shaft socket 15, as shown in Figure 1.

To connect the angled power transmission, the drive shaft ball 20 and pin 21 are introduced into the drive shaft socket 15, the drive shaft pin 21 travelling along the bayonet connection slots 22 against the pressure of the detent spring 24 acting on the drive shaft ball 20. The drive shaft 19 is then rotated and released, the pressure of the detent spring 24 forcing the drive pin 21 into the locking groove 23, as in Figures 1 and 2.

Torque from the driven rotational element 2 is now transferred to the drive shaft 19 via the engagement of the drive shaft pin 21 and the locking groove 23. This arrangement allows for rapid connection and disconnection without tools and will also accommodate a degree of angular misalignment between the power transmission coupling and the drive shaft

The invention provides for a mounting bar or bracket 18, as shown in Figures 1 and 2. The axle 5 is secured immovably to the mounting bar with a pin 17 or similar device of known design. Therefore as long as the mounting bar remains fixed, so will the axis of the output from the angled power transmission coupling. This is of particular value for applications such as wind/water generators where a rotor running normal to a wind or water stream requires its rotary output to be translated through a set angle and then transmitted along the axis of an alternator placed at some distance from the rotor.

Versions of the present invention are capable of translating rotary motion through a wide range of angles, as appropriate to specific applications. For example, figure 8 illustrates an embodiment of the angled power transmission coupling where the translational angle is 38°. In this case, both axle 5 and pins 8 are bent through 38° and the conic mating surfaces 9, 10 of the two rotational elements 1, 2 are machined to 19° relative to the element's axis.

CLAIMS

1. An angled power transmission coupling, wherein the driven transmission element can be mounted concentrically to and on the axis of rotating devices such as wind turbines and water impellers/propellers, thereby forming an integral part of the hub of such rotary devices.

2. An angled power transmission coupling as claimed in Claim 1, wherein driving and driven elements are positioned axially at either side of a bend or joint in a common integral axle, the angle of rotational translation being determined by the angle formed by the bend or joint in the common integral axle.

3. An angled power transmission coupling as claimed in Claims 1 and 2, wherein the common integral axle provides at one end a means for mounting the angled power transmission together with its rotary device, as well as providing a means whereby the axial direction of the translated drive can be aligned, maintained or selectively adjusted.

4. An angled power transmission coupling as claimed in Claims 1, 2, and 3, wherein the driving and driven transmission elements are bored centrally along their axes to accommodate the common integral axle, and concentrically along their axes to accommodate a multiplicity of drive pins.

5. An angled power transmission coupling as claimed in Claim 4 and any preceding claim, wherein rotational motion is transmitted between the driving and the driven transmission elements by the action of a multiplicity of drive pins sliding and rotating in axial holes arranged concentrically around the axis of the said elements.

6. An angled power transmission coupling as claimed in Claim 4, 5 and in any preceding claim, where the drive pins are bent or joined, usually at their centres, to the same angle as the common integral axle.

7. An angled power transmission coupling as claimed in any preceding claim, where adjacent faces of the driving and driven transmission elements may be shaped conically such that the angle of each corresponds to half the total angle through which the power transmission coupling translates the drive.

8. An angled power transmission coupling as claimed in any preceding claim, wherein conical shaping of adjacent faces of the transmission elements allows for the elements to bear against each other when running, eliminating the need for axle bushes to carry axial loads at either side of the bend or joint in the common integral axle.

9. An angled power transmission coupling, as claimed in Claim 8 and any preceding claim, wherein the axle and drive pin holes on the conic faces are relieved in order to provide a clearance for the bend radius of the common integral axle and drive pins.

10. An angled power transmission coupling as claimed in Claim 9 and any preceding claim, wherein the axial drive pin holes in the driving and driven transmission elements are provided with a means to avoid pumping losses or hydraulic/pneumatic lock.

11. An angled power transmission coupling as claimed in any preceding claim, wherein a means is provided to releasably connect a drive shaft or similar torsional device to the driven

transmission element in order to transmit translated rotary motion to its destination.

12. An angled power transmission coupling as claimed in any preceding claim, wherein the releasable drive shaft connection to the driven transmission element may be provided with a means to allow for a degree of angular misalignment by the use of a keyed ball and socket or similar device of known design.

13. An angled power transmission coupling substantially as described herein with reference to Figures 1 to 8 of the accompanying drawings.

INVESTOR IN PEOPLE

Application No: GB 0030438.6 **Examiner:** J. C. Barnes-Paddock
Claims searched: 1-13 **Date of search:** 19 February 2002

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): F2K (K4B3) F2U

Int Cl (Ed.7): F03D 11/02; F16D 3/08

Other: Online: WPI EPODOC PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	US4311435	(BERGERO) See Figures 2 and 3. 90° angled transmission concentric with and forming part of a wind turbine hub unit.	1
X	US2417022	(STAGG) See Figure1. 90° angled transmission concentric with and forming part of a wind turbine hub unit.	1
X;Y	US2811025	(REDARD) See Figures 1 and 2 Angled coupling with bent axle supporting driving and driven members linked by bent rods.	X:1-6,11 Y:10
X	CH272368 A	(KOBLER) See the Figures. Angled coupling with bent axle supporting driving and driven members linked by bent rods.	1-6,11
X;Y	DE0271663	(JONSSON) See Figure 3. Angled coupling with conical adjacent driven/driving members.	X:1-9,11 Y:10
X	JP630219917 A	(NISHIMURA) See the Figures and PAJ abstract. Angled coupling with jointed common axle and pins.	1-6,11

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.